NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Acre)

CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

PURPOSES

- To budget and supply nutrients for plant production.
- To minimize agricultural nonpoint source pollution of surface and ground water resources by properly utilizing manure or organic by-products as a plant nutrient source.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations pertaining to on farm manure as well as additional materials imported to the farm. The owner or operator shall be responsible for securing any and all permits required for activities of the plan.

Plans for nutrient management in Vermont will follow the University of Vermont's *"Nutrient Recommendations for Field Crops in Vermont"* and the Vermont Accepted Agricultural Practice Regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified through the Vermont NRCS Certification Program for Nutrient Management Specialists. Persons who develop nutrient management plans for USDA programs must be certified or work under the direction of a Certified Nutrient Management Specialist. Producers can produce their own nutrient management plans upon attending nutrient management training; these plans will be reviewed and approved by a certified nutrient management specialist.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

If all collected agricultural waste is exported to land not owned or controlled by the producer, a nutrient management plan is not required. In situations where only a percentage of agricultural waste is to be exported, a nutrient management plan is required only on the land that is owned and controlled by the producer. In both cases, documentation shall be furnished on the amount of waste being exported, the nutrient analysis of the material and who will be responsible for the use of the exported waste.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water. The Vermont Manure Budget Screening Tool or UVM's CropMD can be used for this assessment. If excess nutrients are available, develop alternatives for off-farm use.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available. A realistic yield goal is one which is achievable 60% of the time. If the goal is not achieved, the entire crop management system shall be re-evaluated to identify those factors, other than soil fertility, that are limiting yield.

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients.

Field Risk Assessment

A field by field assessment will be conducted to flag environmentally sensitive features using Table A-1, A-2, B-1, B-2, the Vermont NRCS Nutrient Environmental Risk Assessment Tool (Access Database), or UVM CropMD. Identify sensitive areas adjacent to or near the fields to receive nutrients and locate them on plan maps:

- Wells and other potable water supplies.
- Vegetated drainageways or waterways.
- Streams, rivers, lakes, ponds and seasonally flooded or ponded wetlands.
- Property lines.

Where nutrients are applied, soil erosion will be controlled to tolerable soil loss limits as determined by the Revised Universal Soil Loss Equation (Section I of the Vermont NRCS Field Office Technical Guide (FOTG) where there is a risk of polluted runoff carrying sediment or sediment-borne nutrients degrading surface water.

Soil loss on fields receiving manure for an approved Comprehensive Nutrient Management Plan must be controlled to tolerable soil loss levels.

Nutrient Application Setbacks and Restrictions

To protect surface and ground water (private and public wells) from runoff and leaching, water management controls such as vegetative buffers and/or nutrient application setbacks shall be installed on fields with sensitive areas that receive nutrients. Utilize Filter Strip, Practice Code 393 or Riparian Forest Buffer, Practice Code 391. The location of sensitive areas and setbacks or buffers to protect them shall be discussed with the producer during the development of the plan and documented in the plan. The plan shall document the rationale for the established numerical setback or buffer. For nutrient sensitive sites, see appendix C, "Guidance for Nutrient Application Setbacks and Restrictions". Note: Sites with documented conservation practices implemented (such as conservation crop rotation, erosion and runoff practices, filter strips, riparian forest buffers, etc.) can be exempt from setback guidance if appropriate application rate, timing, method and source are employed.

The Vermont AAP's require that "Adjoining waters shall be buffered from row crop lands by at least 25 feet of perennial vegetation where ordinary rainfall events enter adjoining waters by sheetflow runoff and by at least 50 feet of perennial vegetation where ordinary rainfall events enter adjoining waters by channelized runoff." These vegetative buffers may be harvested. In addition, this standard requires that fertilizer be limited to the use of commercial fertilizer applied during the growing season according to soil test recommendations.

Do not apply nutrients within intermittent ditches, diversions, grassed waterways, drainage ditches or other areas of concentrated flow. Do not spread manure or commercial fertilizer nutrients over bedrock outcrops or on frozen or snow-covered ground. The Vermont AAP's impose a manure spreading ban between December 15 – April 1.

Avoid applying nutrients during normal flooding periods on the fields with historical flooding. On row crop fields with overland flows, manure shall be incorporated within 48 hours.

Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on current soil test results developed in accordance with the University of Vermont's guidance or industry practice if recognized by UVM. Current soil tests are those that are no older than three years.

Soil samples shall be collected and prepared according to UVM guidance or standard industry practice. Soil test analyses shall be performed by:

- The UVM Soil Testing Laboratory; or
- Laboratories whose tests are accepted by UVM.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, nitrogen (PSNT), phosphorus, and potassium.

Plant Tissue Testing

Tissue sampling and testing, where used, shall be done in accordance with UVM standards or recommendations.

Nutrient Application Rates

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients.

Recommended nutrient application rates shall be based on The University of Vermont's *"Nutrient Recommendations for Field Crops in Vermont"* (and/or industry practice when recognized by the university) that consider current soil test results, realistic yield goals and management capabilities. The University of Vermont's *"Nutrient Recommendations for Field Crops in Vermont"* utilize the following soil testing protocol: Available Phosphorous extracted with a modified Morgan solution and reactive Aluminum in the same extractant. Available Potassium extracted using NH^4 acetate, pH of 4.8.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- **Nitrogen Application** - Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.
- **Phosphorus Application -** Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.
- **Potassium Application** - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.
- **Other Plant Nutrients -** The planned rates of application of other nutrients shall be consistent with UVM or industry practice if recognized by UVM.
- **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with UVM recommendations, or industry practice if recognized by UVM. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

Nutrient Application Methods

Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Practice Code 449). The application rate (in/hr) and application amounts for material applied through irrigation shall not be at rates which result in runoff. Consult the soil survey for infiltration/permeability rates and available water capacity for the soil(s) receiving the application. Limit application to the volume of liquid that can be stored in the root zone.

Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source

Nutrient values of manure and organic by-products (excluding sewage sludge) shall be determined prior to land application based on laboratory analysis. Manure storages will be sampled annually as close as possible to the time of application (upon thorough agitation of the system) for two years, then evaluate needs. Additional testing will be needed, for example, if variability of base line test is large, weather conditions are extreme, or feed program changes. Field Stacking Sites: Test for at least one stack per year for two years, then evaluate records.

Take credit for nutrients supplied legumes, manure, or other bio-solids. See *"Nutrient Recommendations for Field Crops in Vermont"* for numerical credits.

Nutrient Application Rates

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

Nitrogen Application - When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

The level of nitrogen management will be based on the nitrate leaching index in Section II of the NRCS FOTG.

Leaching Index	Response
<2	No specific constraints
2-10	Nutrient management practices such as split nitrogen application rates, pre-sidedress nitrogen testing and use of nitrification inhibitors should be considered.
>10	Requires intense nitrogen management to minimize nitrate movement, including: careful management of applied nitrogen, avoidance of fall spreading on bare ground, precise timing to match crop utilization, conservation practices that restrict water percolation and leaching, and cover crops that capture and retain nutrients in the upper soil profile.

Phosphorus Application - When manure or other organic by-products are used, the planned rates of phosphorus application shall be consistent with the Phosphorous Index (See http://pss.uvm.edu/vtcrops/NutrientMgt.html#Guidelines) . Use the Phosphorous Index Screening Matrix to determine which fields to conduct the rating. For those fields that do not require the P index, use a Nitrogen based application rate. Soil P levels and P loss potential may increase in the future due to continued nitrogen based management.

Phosphorus Index (PI) Rating. Interpreting the P loss rating determined by the PI is based on phosphorus loss potential due to site and transport characteristics as well as management practices and P source characteristics. The PI is to be used as a planning tool to assist the planner and producer in determining appropriate practices to minimize P transport into surface waters.

1. LOW potential for P movement from this site given current management practices and site characteristics. There is a low probability of adverse impact to surface waters from P losses from this site. Nitrogen-based nutrient management planning is satisfactory for this site. Soil P levels and P loss potential may increase in

the future due to continued nitrogen-based management.

2. MEDIUM potential for P movement from this site given current management practices and site characteristics. Practices shall be implemented to reduce P losses by surface runoff, subsurface flow, and erosion. Nitrogen based management can be implemented until available P levels reach 20 ppm or more during which time P applications should be limited to crop removal rates of P or soil test recommendations for P, whichever is greater.
3. HIGH potential for P movement from this site given current management practices and site characteristics. Phosphorus based nutrient management planning shall be limited to crop removal rates for P or soil test recommendations for P. All practical management practices for reducing P losses to surface runoff, subsurface flow, or erosion shall be implemented.
4. VERY HIGH potential for P movement from this site given current management practices and site characteristics. No manure shall be applied to this site. Phosphorus application should be limited to soil test recommendations. Active remediation techniques shall be implemented to reduce P loss potential from this site.

The crop nutrient removal rates are found in *"Nutrient Recommendations for Field Crops in Vermont*."

The use of certain conservation practices may reduce the risk of P movement, thereby lowering the risk level from a higher category to a lower category.

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. When such applications are made, the application rate shall:

- Not exceed the recommended nitrogen application rate during the year of application, or
- Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application. (See *"Nutrient Recommendations for Field Crops in Vermont."*)
- Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.

The application of manure or organic by-products will be in accordance with the standard WASTE UTILIZATION (633). This includes the development of alternative uses of the manure or organic by-products if excess nutrients exist.

Field Risk Assessment

When animal manures or other organic by-products are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed using the Phosphorous Index as indicated above. In such cases, plans shall include:

- A record of the assessment rating for each field or sub-field, and
- Information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

Heavy Metals Monitoring

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Where non-farm bio-solids are to be utilized for crop nutrients, recommended application rates will be determined by using current UVM recommendations for the crop to be grown. These materials must be applied as prescribed by federal, state, or local regulations. Appropriate documentation must be

maintained according to state regulations. The Vermont Department of Environmental Conservation (DEC) regulates the collection, handling, burning, storage, treatment, land application, disposal, and transportation of bio-solids, septage, or any produce containing these materials which is generated or utilized in Vermont.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources

In areas with an identified or designated nutrient-related water quality impairment, an assessment shall be completed of the potential for nitrogen and/or phosphorus transport from the field. See Vermont's DEC's latest 305b Report and 303d list of impaired waters. The Nitrate Leaching Index (LI) and/or Phosphorus Index (PI), or other recognized assessment tools, may be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the plan.

Plans developed to minimize agricultural nonpoint source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field. Practices include: Conservation Crop Rotation (328), Filter Strip (393), Riparian Forest Buffer (391), Grassed Waterway (412), Cover and Green Manure Crop (340), Diversion (362), Contouring (330), Stripcropping (585, 586), and Residue Management (329).

Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition. Use of nutrient sources with high salt content will be minimized unless provisions are used to leach salts below the crop root zone.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

CONSIDERATIONS

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider additional practices such as Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strips (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Cover and Green Manure (340), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.

Consider cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

- Split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- Avoiding fall and early winter nutrient application for spring seeded crops,
- Band applications of phosphorus near the seed row,
- Applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques, and/or
- Immediate incorporation of land applied manures or organic by-products,
- Delaying field application of animal manures or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Consider soil testing crop fields annually for the first three years to establish a baseline and then test ever three years thereafter.

Consider the annual use of the pre-sidedress nitrate test (PSNT) on all silage corn fields on sensitive sites such as fields with moderate to high nitrate leaching potential and fields with wells or waterbodies in close proximity. The PSNT can help minimize costs associated with side-dressing of nitrogen fertilizer and can also give the producer and planner an indication of the effectiveness of the manure management program.

Consider dominant soil types when making nutrient management recommendations. Highly permeable sands and gravels and soils that are shallow to bedrock provide poor ground water protection. Steeply sloping soils and those with very low permeability have increased instances of runoff. Timing and placement of nutrients are critical on marginal soils. Split or foliar applications will reduce risk to ground water. On soils with seasonal high water tables, nutrients should be applied after mid June and before mid September.

Soil pH can impact the availability of both soil and applied phosphorous. Plan to adjust low pH soils to levels best suited for the crops being grown.

Soil tilth and organic matter content are very important in plant nutrient absorption, root development, and desirable soil structure. Use organic nutrients and green manure as much as possible and avoid excessive field operations, which may result in soil compaction.

Consider testing for organic matter content along with a standard soil test. In addition to its importance to soil quality, organic matter can impact the effectiveness of herbicide application.

Residuals storage options may enhance proper nutrient applications (ex. Remote storage to more evenly distribute manure).

Continuous application of residuals can result in an imbalance of base cations. Monitor soil test levels to avoid imbalances

Evaluate use of plant varieties and cropping systems that enhance nutrient uptake.

Incorporation: In heavy rains, surface applied manure can be lost in eroding soil or runoff water. At times, excessive amounts of manure are used to make up for losses. In addition, economic loss of nutrient value can be high.

Manure applied on cropland should be incorporated as soon as possible to minimize nutrient loss, particularly on areas where runoff potential is high or odor is a concern. Weather patterns should be observed to avoid spreading prior to heavy rains. Losses of available ammonium N from un-incorporated manure are rapid. In addition to economic considerations, nitrogen management is particularly important where soil test levels of P or K are approaching the excessive range.

Consider effects on increasing organic matter on water holding capacity of the soil.

Consider impacts of nutrients, metals, and other contaminants on animal health.

Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.

Consider using soil test information no older than one year when developing new plans, particularly if animal manures are to be a nutrient source.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- Identification of landowner, plan developer, and certified nutrient management specialist approving the plan,
- Identification of landowner objectives that takes long term goals and available land base into consideration.
- Aerial photograph or map and a soil map of the site,
- Current and/or planned plant production sequence or crop rotation,
- Results of soil, plant, water, manure or organic by-product sample analyses,

- Realistic yield goals for the crops in the rotation,
- Quantification of all nutrient sources,
- Recommended nutrient rates, timing, form, and method of application and incorporation,
- Location of designated sensitive areas or resources and the associated, nutrient management restriction,
- Guidance for implementation, operation, maintenance, recordkeeping, and
- Complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.

If increases in soil phosphorus levels are expected, plans shall document:

- The soil phosphorus levels at which it may be desirable to convert to phosphorus based implementation,
- The relationship between soil phosphorus levels and potential for phosphorus transport from the field, and
- The potential for soil phosphorus drawdown from the production and harvesting of crops.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

In addition to the requirements described above, plans for nutrient management shall also include:

- Discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion about nitrogen should include information about nitrogen leaching into shallow ground water and potential health impacts. The discussion about phosphorus should include information about phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.
- Discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment.
- A statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- Annual plan review to determine if adjustments or modifications to the plan are needed. Annual plan reviewers need not be certified, nor NRCS employees. However, revisions to the plan must be approved by a certified nutrient management specialist. Plans should be reviewed and revised as necessary when changes occur with crop types, animal number changes, land base changes, etc. A certified nutrient management specialist shall do a thorough review of the nutrient management plan on a three-year cycle.
- Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- Calibration of application equipment to ensure uniform distribution of material at planned rates.
- Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
  - Soil test results and recommendations for nutrient application,
  - Quantities, analyses and sources of nutrients applied,
  - Dates and method of nutrient applications,

- Crops planted, planting and harvest dates, yields, and crop residues removed,

- Results of water, plant, and organic by-product analyses, and
- Dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements. A record keeping system such as UVM's CropMD or NRCS Nutrient Management Templates (Record Keeping Worksheets) will be used.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.

REFERENCES

Nutrient Recommendations for Field Crops in Vermont 1999, University of Vermont

Williams, J.R., and D.E. Kissel. 1991. Water percolation: An indicator of nitrate nitrogen leaching potential. (In) R.F. Follett, D.R. Keeny, and R.M. Cruse (eds), Managing Nitrogen for Groundwater Quality and Farm Profitability, Soil Science Society of America, Madison, WI.

Section II.iii.C. of the Vermont Field Office Technical Guide.

Proceedings from the 1988 Water Quality Workshop, Integrating Water Quality and Quantity into Conservation Planning. October 1988.

Nutrient Management Plan — Environmental Concerns Checklist

Producer Name:	Farm Name:	Farm #:	Tract #:

Assisted By:	Date:

Field ID	Soil Types and Extent	Dominant Drainage Class	Minimum Depth to Bedrock	Leaching Potential[1]	Erosion Rate	Soil Test Level	Water Quality Site Consideration[2]	Current Management Practices	Other Site and Soil Limitations	Nutrient Management Recommendation[3]

[1] or permeability or hydrologic group
[2] consider flooding potential, drinking water supplies, and surface water
[3] can use narrative section below to document recommendations

Producer Name:	Farm Name:	Farm #:	Tract #:

Assisted By:	Date:

Recommendations due to site and/or soil limitations for nutrient application, site sketch (if desired)

Nutrient Management Plan
Environmental Concerns Checklist

Producer Name:	Tract Number:	Field Number:

Field Name:	Field Acres:

Assisted By:	Date:

Soil Limitations:

Soil Type	Acres or Approx. % of Area	Dominant Drainage Class	Depth to Bedrock	Leaching Potential	Erosion Rate	Other Concerns

Soil Test Levels: N: _____, P: _____, K: _____

Other:

Site Limitations:

Flooding Potential (Frequency and Duration):

Drinking Water Supply (Proximity, Well Type, Condition, Topography):

Surface Waters (Proximity, Type, Topography):

Current Management Practices:

Other Site Considerations:

Producer Name:	Tract Number:	Field Number:

Field Name:	Field Acres:

Assisted By:	Date:

Recommendations due to site and/or soil limitations for nutrient applications, site sketch (if desired)

GUIDANCE FOR NUTRIENT APPLICATION SETBACKS AND RESTRICTIONS

Nutrient Application Setbacks or vegetative buffers (filter strips) are recommended between field's edge and normal high water mark of waterbodies and other identified water features for each field. See Reference Setbacks below.

Definition: An **application setback** is an area that can be cropped but cannot receive nutrients from manure or commercial fertilizer.

Definition: A **buffer** is a strip of perennial vegetation that is designed to help promote infiltration of runoff, deposition of sediment and organics, and removal of nutrients in runoff water. The buffer strip may be harvested for hay (unless USDA other programs present harvesting constraints). Fertilization on buffers will be limited to the use of commercial fertilizer according to soil test recommendations and applied during the growing season.

FEATURES NEEDING SETBACKS

Setbacks or buffers can be an effective management measure to protect water quality and neighbor/community relationships. Setbacks should be considered for any feature or land use that may be impacted by a nutrient application and manure spreading activity. Some examples of features and land uses that should have setbacks or buffers from spreading sites include the following:

- Rivers
- Lakes
- Seasonally Flooded or Ponded Wetland
- Springs
- Seeps
- Drainage Ditches
- Non-Vegetated Swales
- Property Lines
- Private Wells
- Neighboring Residential Dwellings
- Intermittent and Perennial Streams and Brooks
- Ponds
- Marine Waters
- Diversion Ditches
- Gullies
- Ravines
- Roads
- Public Water Sources
- Neighboring Commercial Dwellings

FACTORS TO CONSIDER IN ESTABLISHING SETBACK DISTANCES OR BUFFER WIDTHS

Actual setback distances or buffer widths should be determined on a site specific basis, taking into consideration such factors as what the manure spreading is being setback from, site specific conditions, time of year or season and the farming practices used on the farm. Professional judgement should be used. The nutrient management plan should include the setbacks and the justification for those setbacks. Some of the site-specific criteria and management practices that should be considered when establishing and justifying site-specific setbacks include the following list. One should consider all the criteria that may apply to a site, not just a single factor.

In addition to AAP's, the following factors will be considered:

- **Slope Direction** – All other things being equal, larger setbacks are needed for spreading areas that slope toward a feature or concern than for areas that slope away from the feature.

- **Percent Slope of Crop Field** – All other things being equal, the steeper the slope, the larger the setback should be. For example, on a nearly flat slope or one where the waterbody is located at an elevation higher than the manure spreading site, a setback of less than 20 feet may be appropriate. If however, the slope is greater than 15%, a setback of greater than 100 feet may be needed.

- **Setback Recommendations Based on Slope** – The flatter the slope the more effective in controlling potential runoff from the spreading site and would require smaller setbacks. Some typical guidelines for setback widths are as follows:
  0 to 3% slope – 25 feet
  3% to 8% slope – 35 feet
  8% to 15% slope – 50 feet
  >15% slope – 70 feet

- **Soil** – The soil found in the crop field has a significant role in determining the potential for nutrient export to an off-site area. Some soils result in higher amounts of runoff than others. Some soils have a greater capacity to allow runoff water to infiltrate than others do and therefore provide better treatment. Such factors as soil texture and depth should be considered. In certain situations, a buffer may be required to control runoff to sensitive features. Sandy soils can absorb rainfall more quickly than high clay content soils (greater infiltration and less runoff). Deeper soils have more capacity to store water than shallow soils [depth to bedrock and densic material (hardpan) should be considered].

- **Soil Drainage and Permeability** – Soil drainage and soil permeability will also influence the size of the setback. If a soil is poorly drained, it will have less infiltrative ability than a soil that is well drained, at least during the time of year that the water table is high and would require a greater setback. Soils with greater permeability would need less buffer or setback than soils with poor permeability. The opposite may be true if the feature you are looking to protect is a well or spring.

- **Type and Density of Vegetation** – Vegetation can play a major role in the effectiveness of a setback or buffer. It is basically a resistance and infiltration factor. If the vegetation is thin or short and flat, it is much less effective than vegetation that is thick, tall and upright. If the setback area or buffer is forest, it offers the added benefit of an organic duff layer on the mineral soil surface. This duff layer protects the soil surface from erosion and acts as a sponge to absorb water and adsorb nutrients.

- **Crop Row Direction and Tillage Method** – Crop rows tend to direct runoff water. If the crop rows are perpendicular to the contour of the slope, the setback distance could be smaller than if the crop rows run toward the resource. Tillage methods that create ridges and furrows, improve infiltration, and minimize soil disturbance will also decrease the need for large setbacks.

- **Crop Residue** – Crop residues act like mulch by providing resistance to runoff water and reduce nutrient transport off the application site. The effectiveness of the residue is proportional to the amount, distribution and type present.

- **Sensitivity of the Waterbody** – Setback distances should also take into account the sensitivity of the water resources that are being protected. A shallow, eutrophic waterbody that is sensitive to even minor nutrient additions should have greater setbacks than a large deep lake that is not as sensitive or threatened and impaired.

- **Type of Well** – Springs and shallow dug wells may need greater setbacks than deep drilled wells. Public water supplies should also be noted and precautions considered.

- **Timing of Manure Application** – Nutrients will be adsorbed or utilized more rapidly when applied during the growing season than when plants are dormant. Setbacks could be decreased when manure is being spread and the crop and the soil can utilize them quickly. Likewise, setbacks should be increased when applying nutrients during the non-growing season (fall). For USDA programs, manure will not be spread on frozen or snow covered

ground. Manure cannot be field applied anywhere in Vermont between December 15 and April 1.

- **Type of Manure** In some instances, liquid manure may have a greater potential for transport than solid manure. Dry solid manure offers more soil surface protection.

- **Manure Incorporation** – If manure is incorporated or injected, it will not be transported as easily as if it is left on the surface. Manure applications to the surface of tilled land can easily be transported even without visible soil erosion. Manure must be incorporated within 48 hours of application if applied on land subject to overland flow.

- **Presence of Neighbor** – Some neighbors (residential or commercial) are more sensitive to manure odors and potential off site movement of nutrients than others. If a buffer or setback is planned to reduce nuisance complaints, the sensitivity of the neighbor could be very important. The same criteria should also be used when determining setbacks for manure applications that may fall during periods of outdoor activities (Holidays and weekends). It may also serve to notify neighbors in advance when manure application will be occurring, especially if setbacks are narrow.

- **Type of Property Boundary** – Setbacks should be decreased when there is no potential for water quality concerns or nuisance issues with the spreading of manure nutrients. These would include field boundaries that are adjacent to other fields or forested areas.

REFERENCE SETBACKS

If for some reason, site specific nutrient application setbacks cannot be determined, the following setbacks are recommended. These setbacks serve as a point of reference from which a buffer width is increased or decreased, depending on site specific factors. A Decision Support Tree follows to assist the planning process.

- 25' reference setback from intermittent streams and other watercourses such as waterways, diversions, drainage ditches
  - For intermittent streams and other water courses such as waterways, diversions, drainage ditches and road ditches that outlet into woodlands or other areas where treatment of runoff is occurring, avoid spreading manure within the watercourses. (Vegetative buffers would still be desirable along these drainages.)
- Avoid use of manure or commercial fertilizer nutrients within 100' of lakes and ponds (define pond) or maintain a 50' vegetative buffer. The buffer, if not limited by other program constraints, can be harvested for hay. Limit fertilization within the buffer to commercial fertilizer applications according to soil tests and applied during the growing season.
- Consider 25' setback from property boundary
- Consider a 100' buffer or application setback around private wells. Consider the type of well when using the Decision Support Tree below.
- For public water supplies, the Water Supply Rule - Chapter 21, 3.3.1.2 - requires that "The source isolation zone shall be a water system controlled 200 feet radius around the proposed sources unless approved otherwise…"

Decision Support Tree for Setbacks

Criteria	Condition	Setback
0. Starting setback distance for nutrient application		0
1. Slope Direction	If Slope down gradient If Slope up gradient	Use Reference Setback Use 0’
2. Percent Slope of application field	Slope – 0-3% Slope – 3-8% Slope – 8-15% Slope > 15%	Use Reference Setback Add 15% Add 25% Add 50%
3a. Soil Hydrologic Group (Surface Water Concern) (Reverse these if ground water concern)	Group A Group B Group C Group D	Subtract 25% No modification Add 25% Add 50%
4. Soil Drainage Class	Excessive to moderate well drained Well and somewhat poorly drained Poorly to very poorly drained	Subtract 25% No modification Add 25%
5. Vegetation Buffer	Follow practice standard (393) >10’ with some perennial vegetation <10’ perennial vegetation	0 Subtract 25% No Modification
6. Tillage Patterns	Perpendicular to slope with ridges Perpendicular to slope, no ridges Parallel to slope	Subtract 25% No Modification Add 50%
7. Crop Residue	Adequate to protect soil to T, >40% 20-40% cover <20% cover	Subtract 25% Subtract 10% No Modification
8. Sensitivity of waterbody	Non-sensitive Sensitive	No modification Add 50%
9. Timing of Application	Growing season Non growing season	No modification Add 50%
10. Rate or form of nutrients applied		No modification
11. Method of manure/nutrient application	Manure injected Nutrient inject, incorporate or manure incorporated Nutrients surface or manure surface	Subtract 50% Subtract 25% Add 50%
12. Presence of Neighbors	Down-wind gradient, visual Down-wind, not visual Not visual or down-wind	Add 100% Add 50% 0%